

4 comprising:

5 holding means (211) for holding the surface

6 plasmon resonance sensor chip;

7 sample introducing means (282) for assigning a

8 plurality of different samples to said plural flow

9 channels (280), respectively, and for introducing each

10 of the plural samples into the respective flow channel

11 (280) in a state where the surface plasmon resonance

12 sensor chip is held by said holding means (211);

13 light irradiating means (212) for irradiating the

14 sensor surface with light from a predetermined

15 direction in a state where each sample is introduced

16 into the respective flow channel (282) by said sample

17 introducing means (282);

18 light receiving means (213) for receiving the

19 light reflected from the sensor surface;

20 measuring means (213) for measuring the intensity

21 of the light reflected by each said diffraction

22 grating surface (251-254) and received by said light

23 receiving means (213);

24 analyzing means for identifying, for each said

25 flow channel (280), a groove pitch at which a

26 resonance phenomenon of the evanescent wave and the

27 surface plasmon wave occurs, based on the intensity,

28 measured by said measuring means (213), of the

29 reflected light due to each said diffraction grating

30 surface (251-254), and for quantitatively and/or  
31 qualitatively analyzing each sample flowing through  
32 the respective flow channel (280), based on the groove  
33 pitch identified for each said flow channel (280).

1           62. An apparatus for quantitatively and/or  
2 qualitatively analyzing a sample using a surface  
3 plasmon resonance sensor chip as defined in claim 44,  
4 comprising:

5           holding means (211) for holding the surface  
6 plasmon resonance sensor chip;

7           sample introducing means (282) for assigning a  
8 plurality of different samples to said plural flow  
9 channels (280), respectively, and for introducing each  
10 sample into the respective flow channel (280) in a  
11 state where the surface plasmon resonance sensor chip  
12 is held by said holding means (211);

13           light irradiating means (212) for irradiating the  
14 sensor surface with light from a predetermined  
15 direction in a state where each sample is introduced  
16 into the respective flow channel (280) by said sample  
17 introducing means (282);

18           light receiving means (213) for receiving the  
19 light reflected from the sensor surface;

20           measuring means (213) for measuring the intensity  
21 of the light reflected by each said diffraction

22 grating surface (251-254) and received by said light  
23 receiving means (213);

24 analyzing means for identifying, for each said  
25 flow channel (280) and for each of the reaction area  
26 and the non-reaction area, a groove pitch at which a  
27 resonance phenomenon of the evanescent wave and the  
28 surface plasmon wave occurs, based on the intensity,  
29 measured by said measuring means (213), of the  
30 reflected light due to each said diffraction grating  
31 surface (251-254), and for quantitatively and/or  
32 qualitatively analyzing each sample flowing through  
33 the respective flow channel (280), based on the groove  
34 pitches of the reaction area and the non-reaction area  
35 identified for each said flow channel (280).

1 63. An apparatus for quantitatively and/or  
2 qualitatively analyzing a sample using a surface  
3 plasmon resonance sensor chip as defined in claim 39  
4 or 40, comprising:

5 holding means (211) for holding the surface  
6 plasmon resonance sensor chip with the sensor surface  
7 (201a) being in contact with the sample;

8 light irradiating means (212) for irradiating the  
9 sensor surface with light from a predetermined  
10 direction in a state where the surface plasmon  
11 resonance sensor chip is held by said holding means

12 (211);  
13 light receiving means (213) for receiving the  
14 light reflected from the sensor surface;  
15 measuring means (213) for measuring the intensity  
16 of the light reflected by each said diffraction  
17 grating surface (251-254) and received by said light  
18 receiving means (213);  
19 determining means (214) for determining the  
20 variation between the intensity, measured by said  
21 measuring means (213), of the reflected light due to  
22 each said diffraction grating surface (251-254) and  
23 the intensity of the light reflected when any sample  
24 is not in contact with the sensor surface (201a); and  
25 analyzing means (214) for selecting a diffraction  
26 grating surface (251-254) whose variation, determined  
27 by said determining means (214), of the reflected-  
28 light intensity is within a predetermined allowable  
29 range for determination, and for quantitatively and/or  
30 qualitatively analyzing the sample based on the  
31 variation of the reflected-light intensity of the  
32 selected diffraction grating surface (251-254).

1 64. An apparatus for quantitatively and/or  
2 qualitatively analyzing a sample using a surface  
3 plasmon resonance sensor chip as defined in claim 41,  
4 comprising:

5           holding means (211) for holding the surface  
6           plasmon resonance sensor chip with the sensor surface  
7           being in contact with the sample;  
8           light irradiating means (212) for irradiating the  
9           sensor surface with light from a predetermined  
10          direction in a state where the surface plasmon  
11          resonance sensor chip is held by said holding means  
12          (211);  
13          light receiving means (213) for receiving the  
14          light reflected from the sensor surface;  
15          measuring means (213) for measuring the intensity  
16          of the light reflected by each said diffraction  
17          grating surface (251-254) and received by said light  
18          receiving means (213);  
19          correcting means (214) for correcting the  
20          intensity of the reflected light due to each said  
21          diffraction grating surface (251-254) with  
22          consideration given to the intensity of the reflected  
23          light due to the respective non-diffraction surface  
24          (251x-254x);  
25          determining means (214) for determining the  
26          variation between the intensity, corrected by said  
27          correcting means (214), of the reflected light due to  
28          each said diffraction grating surface (251-254) and  
29          the intensity of the light reflected when any sample  
30          is not in contact with the sensor surface;

31           analyzing means (214) for selecting a diffraction  
32           grating surface (251-254) whose variation, determined  
33           by said determining means (214), of the reflected-  
34           light intensity is within a predetermined allowable  
35           range for determination, and for quantitatively and/or  
36           qualitatively analyzing the sample based on the  
37           variation of the reflected-light intensity of the  
38           selected diffraction grating surface (251-254).

1           65. An apparatus for quantitatively and/or  
2           qualitatively analyzing a sample using a surface  
3           plasmon resonance sensor chip as defined in claim 42,  
4           comprising:

5           holding means (211) for holding the surface  
6           plasmon resonance sensor chip with the sensor surface  
7           being in contact with the sample;

8           light irradiating means (212) for irradiating the  
9           sensor surface with light from a predetermined  
10          direction in a state where the surface plasmon  
11          resonance sensor chip is held by said holding means  
12          (211);

13          light receiving means (213) for receiving the  
14          light reflected from the sensor surface;

15          measuring means (213) for measuring the intensity  
16          of the light reflected by each said diffraction  
17          grating surface (251-254) and received by said light

18 receiving means (213);

19 determining means (214) for determining, for each  
20 of the reaction area and the non-reaction area, the  
21 variation between the intensity, measured by said  
22 measuring means (213), of the reflected light due to  
23 each said diffraction grating surface (251-254) and  
24 the intensity of the light reflected when any sample  
25 is not in contact with the sensor surface; and

26 analyzing means (214) for selecting, for each of  
27 the reaction area and the non-reaction area, a  
28 diffraction grating surface (251-254) whose determined  
29 variation of the reflected-light intensity is within a  
30 predetermined allowable range for determination, and  
31 for quantitatively and/or qualitatively analyzing the  
32 sample based on the variation of the reflected-light  
33 intensity of the selected reaction area and the  
34 variation of the reflected-light intensity of the  
35 selected non-reaction area.

1 66. An apparatus for quantitatively and/or  
2 qualitatively analyzing a sample using a surface  
3 plasmon resonance sensor chip as defined in claim 43,  
4 comprising:

5 holding means (211) for holding the surface  
6 plasmon resonance sensor chip;

7 sample introducing means (282) for assigning a

8 plurality of different samples to said plural flow  
9 channels (280), respectively, and for introducing each  
10 of the plural samples into the respective flow channel  
11 (280) in a state where the surface plasmon resonance  
12 sensor chip is held by said holding means (211);

13 light irradiating means (212) for irradiating the  
14 sensor surface with light from a predetermined  
15 direction in a state where each sample is introduced  
16 into the respective flow channel (280) by said sample  
17 introducing means (282);

18 light receiving means (213) for receiving the  
19 light reflected from the sensor surface;

20 measuring means (213) for measuring the intensity  
21 of the light reflected by each said diffraction  
22 grating surface (251-254) and received by said light  
23 receiving means (213);

24 determining means (214) for determining the  
25 variation between the intensity, measured by said  
26 measuring means (213), of the reflected light due to  
27 each said diffraction grating surface (251-254) and  
28 the intensity of the light reflected when any sample  
29 does not flow through each said flow channel (280);

30 and

31 analyzing means for selecting, for each said flow  
32 channel (280), a diffraction grating surface (251-254)  
33 whose variation, determined by said determining means



34 (214), of the reflected-light intensity is within a  
35 predetermined allowable range for determination, and  
36 for quantitatively and/or qualitatively analyzing each  
37 sample flowing through the respective flow channel  
38 (280) based on the variation of the reflected-light  
39 intensity of the diffraction grating surface (251-254)  
40 selected for each said flow channel (280).

1 67. An apparatus for quantitatively and/or  
2 qualitatively analyzing a sample using a surface  
3 plasmon resonance sensor chip as defined in claim 44,  
4 comprising:

5 holding means (211) for holding the surface  
6 plasmon resonance sensor chip;

7 sample introducing means (282) for assigning a  
8 plurality of different samples to said plural flow  
9 channels (280), respectively, and for introducing each  
10 of the plural samples into the respective flow channel  
11 (280) in a state where the surface plasmon resonance  
12 sensor chip is held by said holding means (211);

13 light irradiating means (212) for irradiating the  
14 sensor surface with light from a predetermined  
15 direction in a state where each sample is introduced  
16 into the respective flow channel (280) by said sample  
17 introducing means (282);

18 light receiving means (213) for receiving the

19 light reflected from the sensor surface;  
20 measuring means (213) for measuring the intensity  
21 of the light reflected by each said diffraction  
22 grating surface (251-254) and received by said light  
23 receiving means (213);  
24 determining means (214) for determining, for each  
25 of the reaction area and the non-reaction area, the  
26 variation between the intensity, measured by said  
27 measuring means (213), of the reflected light due to  
28 each said diffraction grating surface (251-254) and  
29 the intensity of the light reflected when any sample  
30 does not flow through each said flow channel (213);  
31 and  
32 analyzing means (214) for selecting, for each  
33 said flow channel (280) and for each of the reaction  
34 area and the non-reaction area, a diffraction grating  
35 surface (251-254) whose variation, determined by said  
36 determining means (214), of the reflected-light  
37 intensity is within a predetermined allowable range  
38 for determination, and for quantitatively and/or  
39 qualitatively analyzing each sample flowing through  
40 the respective flow channel (280), based on the  
41 variation of the reflected-light intensity of the  
42 selected reaction area and the variation of the  
43 reflected-light intensity of the selected non-reaction  
44 area for each said flow channel (280).

1           68. An apparatus as defined in one of claims 58-  
2           67, wherein it further comprises sample separating  
3           means (292) for separating the sample by physical  
4           and/or chemical action prior to introducing the sample  
5           to the surface plasmon resonance sensor chip.

1           69. An apparatus as defined in claim 68, wherein  
2           said sample separating means (292) is operable to  
3           separate the sample by a separation technique using at  
4           least one of liquid chromatography, HPLC (high  
5           performance liquid chromatography), capillary  
6           electrophoresis, microchip electrophoresis, flow  
7           injection, and microchannel.

1           70. An apparatus as defined in one of claims 58-  
2           69, wherein  
3           the target species is a light-emitting substance,  
4           said light receiving means (213) is operable to  
5           detect the light emitted from the light-emitting  
6           substance that is bound to the binding substance, and  
7           said analyzing means (214) is operable to  
8           quantitatively and/or qualitatively analyze the sample  
9           with consideration given to the detection result of  
10          the light emission by said light receiving means  
11          (213).

1           71. A surface plasmon resonance sensor chip  
2 comprising:

3           a metal layer (23) along whose surface a surface  
4 plasmon wave can be induced by light irradiation; and  
5           a diffraction grating curved surface (25)  
6 disposed in the vicinity of said metal layer (23),  
7 said diffraction grating curved surface (25) having a  
8 diffraction grating with a uniform groove orientation  
9 and a uniform groove pitch so as to generate an  
10 evanescent wave upon light irradiation;

11           wherein said diffraction grating curved surface  
12 (25) has a curved surface form in a convex shape whose  
13 light-irradiated side bulges out, and is disposed so  
14 as to be perpendicular to a specific plane (S1), which  
15 is perpendicular to a predetermined reference plane  
16 (S0), and the diffraction grating is formed in such a  
17 manner that the groove orientation is perpendicular to  
18 the specific plane (S1).

1           72. A surface plasmon resonance sensor chip  
2 comprising:

3           a metal layer (233) and a diffraction grating  
4 (235) formed in the vicinity of a sensor surface,  
5 which comes in contact with a sample; and  
6           a resonance area (238a-238d), formed on the

7 sensor surface (231a), for causing a resonance  
8 phenomenon of a surface plasmon wave, which is induced  
9 along the surface of said metal layer (233), and an  
10 evanescent wave, which is generated by the action of  
11 the diffraction grating, upon light irradiation;

12 wherein said resonance area (238a-238d) has a  
13 plurality of continuous areas (238a-238d) discretely  
14 formed on the sensor surface (231a), and at least one  
15 continuous area (238a-238d) among the plural  
16 continuous areas (238a-238d) has a diffraction grating  
17 whose at least one of the groove pitch and the groove  
18 orientation is different from those of the remaining  
19 continuous areas (238a-238d).

1 73. A surface plasmon resonance sensor chip  
2 comprising:

3 a metal layer (233) and a diffraction grating  
4 (235) formed in the vicinity of a sensor surface,  
5 which comes in contact with a sample; and

6 a resonance area , formed on the sensor surface,  
7 for causing a resonance phenomenon of a surface  
8 plasmon wave, which is induced along the surface of  
9 said metal layer (233), and an evanescent wave, which  
10 is generated by the action of the diffraction grating,  
11 upon light irradiation;

12 wherein said resonance area is formed

13 continuously on the sensor surface, and the groove  
14 orientations of the diffraction grating (225) are  
15 uniform while the groove pitches of the diffraction  
16 grating (225) have a continuous or discontinuous  
17 distribution.